

Original Research Article

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Response of Organic Liquid Manures and Biofertilizers on Growth and Yield of Finger Millet (*Eleusine coracana* L.)

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ABSTRACT

A field experiment was carried out during *Kharif* season 2020 at SHUATS Model Organic Farm (SMOF), Department of Agronomy, SHUATS, Prayagraj (UP) on sandy loam soil to investigate the impact of foliar spray of organic liquid manures and seed inoculation of biofertilizer on growth and yield of finger millet. The treatments consisted of Liquid organic manures *viz.*, Jeevamrutha foliar spray at 500 l/ha, Panchagavya foliar spray at 3% and Vermiwash foliar spray at 3% and biofertilizers *viz.*, Azospirillum (seed inoculation @25 g/kg), PSB (Seed inoculation @25 g/kg) and Azospirillum + PSB (Seed inoculation @25 g/kg) whose effect is observed on finger millet (MR-1). The experiment was laid out in randomized block design with ten treatments replicated thrice. Application of Jeevamrutha FS 500 l/ha+Azospirillum+PSB recorded significantly higher plant height (73.90 cm), number of tillers/plant (7.39) and plant dry weight (15.42 g/plant) at harvest stage as compared to all the treatment combinations. The treatment with application of Jeevamrutha FS 500 l/ha+Azospirillum+PSB also recorded significantly maximum number of fingers/ear head (6.31), grain yield (2.82 t/ha) and straw yield (4.62 t/ha) among rest of the treatment combinations.

Keywords

Finger millet, Organic farming, Azospirillum, PSB, Jeevamrutha, Vermiwash, Panchagavya, Yield

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Introduction

Finger millet [*Eleusine coracana* (L.) Gaertn.] commonly known as ragi, which is one of the major staple food crops of Southern region and also an ideal food for patients suffering from diabetes. It occupies the highest area under cultivation among the small millets. The

grains are rich in calcium and iron besides being rich in carbohydrate and protein. In India, it is grown in an area of 1.19 million hectares with the production of 1.98 million tonnes and the productivity is 1661 kg ha⁻¹ (Sakamma *et al.*, 2018). Karnataka is the largest producer of finger millet in India followed by Tamil Nadu, Andhra Pradesh,

Orissa, Jharkhand, Maharashtra and Uttaranchal.

Now a days organic farming practices are gaining importance as farmers have realized the benefits in terms of soil fertility, soil health and sustainable productivity. Organic liquid formulations like jeevamrutha and panchagavya helps for quick buildup of soil fertility through enhanced activity of soil microflora and fauna (Devakumar *et al.*, 2008). These have the properties of both fertilizer and biopesticide and play a key role in promoting growth and immunity to the plant system. They also contain vitamins, essential amino acids, growth promoting substances like Indole Acetic Acid (IAA) and Gibberellic Acid (GA).

Bio fertilizers are being essential component organic farming are the preparations containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilising or cellulolytic micro-organisms used for application to seed, soil are composting ares with the objective of increasing number of such micro-organisms and accelerate those microbial process which augment the availability of nutrients that can be simulated by plants. Azospirillum species belong to facultative endophytic diazotrophic group which colonize the surface and interior of roots.

There are encouraging reports on the use of azospirillum spp. As biofertilizers which contribute to the nitrogen economy of the plants and also promote the plants and also promote the plant growth by producing growth harmones. PSB plays in important role in dissolving phosphorus present in soil that is environmentally friendly and sustainable. PSB with multiple beneficial traits are important to increase the growth and yield of plants. Hence present investigation was initiated to find out the response of organic liquid manures with

bio fertilizer on growth and yield of finger millet.

Materials and Methods

The experiment was carried out during *Kharif* season of 2020 at SMOF (SHUATS Model Organic Farm), Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (UP). The SMOF situated at 25.75° N latitude, 87.19° E longitude and at an altitude of 98m above mean sea level. The soil of the experimental plot was sandy loam soil in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.28%), medium in available N (225 Kg/ha), medium in available P (19.50 Kg/ha) and low indicate available K (92.00 Kg/ha).

The treatment consisted of Liquid organic manures *viz.*, Jeevamrutha foliar spray at 500 l/ha, Panchagavya foliar spray at 3% and Vermiwash foliar spray at 3% and biofertilizers *viz.*, Azospirillum (seed inoculation @ 25g/kg), PSB (seed inoculation @ 25g/kg) and Azospirillum + PSB (seed inoculation @ 25g/kg).

The experiment was laid out in Randomized Block Design. The experiment comprising ten treatment possible combination of above factors *viz.*, T₁: Jeevamrutha FS 500 l/ha + Azospirillum, T₂: Panchagavya FS at 3% + Azospirillum, T₃: Vermiwash FS at 3% + Azospirillum, T₄: Jeevamrutha FS 500 l/ha + PSB, T₅: Panchagavya FS at 3% + PSB, T₆: Vermiwash FS at 3% + PSB, T₇: Jeevamrutha FS 500 l/ha + Azospirillum + PSB, T₈: Panchagavya FS at 3% + Azospirillum + PSB, T₉: Vermiwash FS at 3% + Azospirillum + PSB and T₁₀: Control field observation regarding yield was recorded after harvesting of crop, While on that basis economic evaluation n terms of net return also find out according the technique and analysis of variance.

Results and Discussion

Growth parameters

At harvest, treatment with application of Jeevamrutha FS 500 l/ha+Azospirillum+PSB was recorded higher plant height (73.90 cm) which was significant over all the treatments. However, treatment with application of Panchagavya FS at 3%+Azospirillum+PSB, Vermiwash FS at 3% + PSB and Vermiwash FS at 3% +Azospirillum+PSB were statistically on par with treatment with application of Jeevamrutha FS 500 l/ha+Azospirillum+PSB (Table 1).

The increase in the plant height may be due to increased nitrogen availability with liquid organic manures as well as FYM incorporation in the soil which helped continuous slow release of nutrients providing a better crop growth. In addition, Jeevamrutha spray enhances the growth promoting substances which might helped in acceleration of plant height, number of tillers per/plant and dry matter production (g/plant). Similar results were also observed with the findings of Abdullahi *et al.*, (2014), Govindappa *et al.*, (2009) and Sangeetha *et al.*, (2010). Treatment with application of Jeevamrutha FS 500 l/ha+Azospirillum+PSB was recorded significantly maximum plant dry weight (15.42 g) among all treatments except treatment with application of Panchagavya FS at 3% +Azospirillum+PSB and Vermiwash FS at 3% +Azospirillum+PSB were statistically at par. The total dry matter production of any crop is an important parameter in determining the performance of crop dry matter accumulation in individual part depends on crop tallness, functional leaf area, transformation of photosynthate *etc.* Dry matter production is an important gateway to achieve higher yield. As in the earlier discussion, the application of recommended vermicompost + frond compost + PSB performed superior in terms of tallness,

number of leaves and number of tillers *etc.* These treatments alone necessarily excelled the highest dry matter accumulation at all growth stages (Anil kumar, 2000 and Jayaprakash *et al.*, 2003). At harvest, treatment with application of Jeevamrutha FS 500 l/ha +Azospirillum+PSB was recorded maximum number of tillers (7.39) and which was significant over all the treatments. While, treatment with application of Panchagavya FS at 3% +Azospirillum+PSB and Vermiwash FS at 3% +Azospirillum+PSB were statistically on par with treatment application of Jeevamrutha FS 500 l/ha +Azospirillum+PSB. Most of the nutrients supplied through enriched liquid manures are readily available for plant growth, development and also could have matched crop's demand for nutrients.

Besides, they might have improved the soil aggregation, enhanced soil microbial activity and higher nutrient availability resulting in congenial soil condition. Similar increment in growth parameters like number of tillers per plant was also in field trials conducted to develop package for organic finger millet at several research stations viz., Balajigapade, Chintamani, Naganahally and Navile (Reddy *et al.*, 2011).

Yield attributes

Number of fingers/ear head and test weight

Treatment with application of Jeevamrutha FS 500 l/ha +Azospirillum+PSB was recorded maximum number of fingers per earhead (6.31) and which was significant over all the treatments. However, treatment with application of Panchagavya FS at 3%+PSB, Panchagavya FS at 3% +Azospirillum+PSB and Vermiwash FS at 3% +Azospirillum+PSB were statistically on par with treatment with application of Jeevamrutha FS 500 l/ha +Azospirillum+PSB (Table 2).

Table.1 Effect of organic liquid manures and biofertilizers of growth parameters of finger millet

Treatments		Plant Height (cm)	No. of Tillers/plant	Dry Weight (g/plant)
1.	Jeevamrutha FS 500 l/ha +Azospirillum	70.00	6.44	14.07
2.	Panchagavya FS at 3%+Azospirillum	71.01	6.14	14.87
3.	Vermiwash FS at 3%+Azospirillum	70.60	5.98	14.90
4.	Jeevamrutha FS 500 l/ha +PSB	68.43	6.66	14.12
5.	Panchagavya FS at 3%+PSB	70.94	6.04	14.57
6.	Vermiwash FS at 3%+PSB	72.25	6.34	14.66
7.	Jeevamrutha FS 500 l/ha +Azospirillum+PSB	73.90	7.39	15.42
8.	Panchagavya FS at3%+Azospirillum+PSB	73.53	7.01	15.12
9.	Vermiwash FS at3%+Azospirillum+PSB	71.83	6.79	15.17
10.	Control (FYM)	69.68	6.12	14.31
SEm(±)		0.80	0.20	0.16
CD (P=0.05)		2.38	0.62	0.49

Table.2 Effect of organic liquid manure and biofertilizers on yield attributes and yield of finger millet

Treatment	No. of fingers/ear head	Test weight	Grain yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1.Jeevamrutha FS 500 l/ha +Azospirillum	5.23	2.97	2.51	4.22	37.31
2.Panchagavya FS at 3%+Azospirillum	5.17	3.07	2.36	4.24	35.78
3.Vermiwash FS at 3%+Azospirillum	5.65	2.99	2.58	4.27	37.70
4.Jeevamrutha FS 500 l/ha +PSB	5.63	2.86	2.16	4.15	34.25
5.Panchagavya FS at 3%+PSB	5.22	2.68	2.62	4.36	37.60
6.Vermiwash FS at 3%+PSB	5.71	3.09	2.41	4.53	34.70
7.Jeevamrutha FS 500 l/ha +Azospirillum+PSB	6.31	3.26	2.82	4.62	37.92
8.Panchagavya FS at3%+Azospirillum+PSB	6.19	2.87	2.74	4.37	38.56
9.Vermiwash FS at3%+Azospirillum+PSB	6.15	3.06	2.69	4.50	37.45
10.Control (FYM)	5.30	2.73	2.15	4.14	34.20
SEm(±)		0.20	0.12	0.63	1.09
CD (P=0.05)		0.62	NS	1.89	2.44

Treatment with application of Vermiwash FS at 3% +Azospirillum was recorded maximum test weight (3.26g) and the minimum (2.73 g) test weight was recorded with control plot and there was no significant difference among treatment. Yield attributing characters, viz. number of productive tillers hill, number of fingers per hill, were significantly influenced by different solid and foliar spray of liquid organics. Similar findings were confirmed by Jayaprakash *et al.*, 2003 and Senapati *et al.*, 2002.

Yield

Treatment with application of Jeevamrutha FS 500 l/ha +Azospirillum+PSB was recorded maximum grain yield (2.82 t/ha) and application of Panchagavya FS at 3% +Azospirillum+PSB and Vermiwash FS at 3% +Azospirillum+PSB were statistically on par with treatment with application of Jeevamrutha FS 500 l/ha +Azospirillum+PSB. Treatment with application of Jeevamrutha FS 500 l/ha +Azospirillum+PSB was recorded maximum stover yield (4.62 t/ha) and among all treatment combinations, Jeevamrutha FS 500 l/ha+Azospirillum+PSB except treatment with application of Panchagavya FS at 3% +PSB and Vermiwash FS at 3% +Azospirillum+PSB were on par. Treatment with application of Panchagavya Foliar spray at 3% +Azospirillum+PSB was recorded maximum Harvest index (38.56 %) and the minimum harvest index(34.20 %) was recorded with control plot and there was no significant difference among treatment. The highest grain and straw yield was recorded with application of Jeevamrutha FS 500 l/ha +Azospirillum+PSB might be attributed to better supply of nutrients along with conducive physical environment leading to better root activity and higher nutrient absorption, which resulted in more plant growth and superior yield attributes responsible for higher yield. The application

of biofertilizers (*Azospirillum*) increased the efficiency of chemical fertilizers due to control release of nutrients in the soil through microbial activity which might have facilitated better crop growth. The present findings are in accordance with findings of Abbasi and Yousra (2012) and Acharya *et al.*, (2012).

It may concluded that for obtaining higher yield components with organic quality finger millet production higher with application of Jeevamrutha FS 500 l/ha +Azospirillum + PSB was found more productive (2.82 t /ha). Application of organic manure along with seed inoculation of biofertilizer could be viable option for sustaining productivity of millets under eastern UP condition.

References

- Abbasi, M.K. and Yousra, M. 2012. Synergistic effects of biofertilizer with organic and chemical N sources in improving soil nutrient status and increasing growth and yield of wheat grown under greenhouse conditions. *Plant Biosystems*. 146: 181-189.
- Abdullahi, R., Sheriff, H.H. and Buba, A. 2014. Effect of biofertilizer and organic manure on growth and nutrients content of pearl millet. *APRN Journal of Agricultural and Biological Science*. 9(10): 351-355.
- Anil kumar, B. H. 2000. Integrated use of organic and inorganic manures on growth and yield of finger millet under rainfed conditions, M.Sc., (Agri.) Thesis, Submitted in UAS, Bangalore.
- Acharya, R., Dash, A.K. and Senapati, H.K. 2012. Effect of integrated nutrient management on microbial activity influencing grain yield under rice-rice cropping system in an acid soils. *Asian Journal of Microbiology, Biotechnology and Environmental Sciences*. 14: 365-368.

- Devakumar, N., Rao, G.G.E., Shubha, S., Imrankhan, N., And Gowda, S.B., (2008) Activates of Organic Farming Research Centre. Navile, Shimoga, University of Agriculture Sciences Bangalore, 12 p.
- Govindappa., M, Vishwanath., A.P, Harsha., K.N, Thimmegowda., P. and Jnanesh., A.C., 2009. Response of finger millet (*Eleusine coracana* L.) to organic and inorganic sources of nutrients under rainfed condition. *J Crop Weed.*,5:291-293.
- Jayaprakash., T. C., Nagalikal., V. P., Pujari., B. T. and Setty, R. A. 2003. Effects of organics and inorganics on yield and yield attributes of maize under irrigation. *Karnataka J. Agric. Sci.*,16: 451-453.
- Reddy, V. C., Jayaram Reddy., M., Shivanandam., V. N., Yogananda., S. B., Govindaraju., C. and Jagadeesh., B. R. 2011. Developing package of practices for production of finger millet through compost and bio digester liquid manure. *Ann. Prog. Report*, Research Institute on Organic Farming. *Univ. Agric. Sci., Bangalore.* pp. 13-21, 23-26, 30-34 & 47-48.
- Sakamma., S., Umesha., K.B., Girish., M.R., Ravi., C.S., Satishkumar., M. and VeerabhadrapaBellundagi. 2018. Finger Millet (*Eleusine coracana* L. Gaertn.) Production System: Status, Potential, Constraints and Implications for Improving Small Farmer's Welfare. *Journal of Agricultural Science*: 10(1).
- Sangeetha., R. Geetha., A. and Arulpandi., I. 2010. Concomitant Production of Protease and Lipase by *Bacillus Licheniformis* VSG1: Production, Purification and Characterization. *Brazilian Journal of Microbiology* 41: 179-185.
- Senapati., H. K. and Padhihari., H. K., 2002. Effect of organic, inorganic fertilizers and liming on persistence and degradation of phorate in acid laterite soil of Orissa. *J. Indian Soc. Soil Sci.*, 50(2): 168 – 171.

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